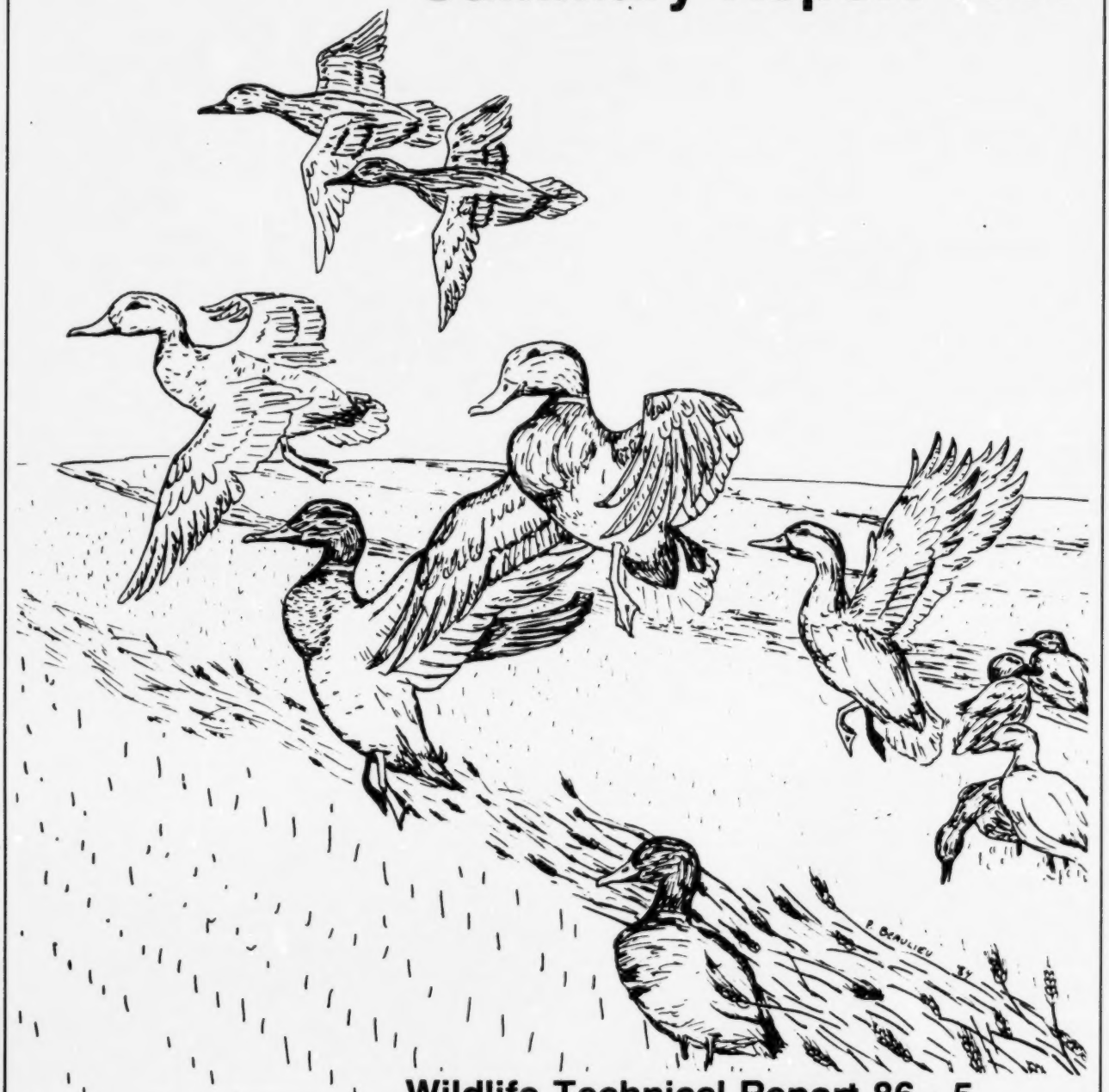
Saskatchewan
Parks and
Renewable
Resources

Waterfowl Crop Damage Control Program

Summary Report 1985



Wildlife Technical Report 86 - 5

SASKATCHEWAN WATERFOWL CROP DAMAGE CONTROL PROGRAM

SUMMARY REPORT 1985

by

M. A. Gollop

Wildlife Branch

Saskatchewan Parks and Renewable Resources

#15 Innovation Blvd.

Saskatoon, Saskatchewan

July 1986

Permission To Quote

The data presented in this report may be subject to future revisions. Persons wishing to quote from this report, to cite it in bibliographies, or to use it in any form, must first obtain permission from the writer or the Director of Wildlife.

ABSTRACT

A waterfowl crop damage prevention program was operated in Saskatchewan in 1985. The program was cost shared 50:50 under a five year (1983/84 to 1987/88) Federal-Provincial Agreement. The objective of the program was to minimize waterfowl depredation on grain crops. Methods involved feeding waterfowl at lure crops and bait stations and providing scare cannons for free distribution to farmers.

Lure crops and/or bait stations were operated in 27 Crop Damage Control Units in 1985 and a total of 851 scare cannons were available for landowner use from 41 SPRR district offices.

Area specific planning studies were concluded in four new areas and initiated in five new areas. Complete evaluations of active areas were conducted in two Crop Damage Control Units and partial evaluations in five additional units.

Total cost of the 1985/86 program is estimated at $797,509.

This report is intended to fulfill all obligations under Section 3(5) of the Canada-Saskatchewan Agreement.

ACKNOWLEDGEMENTS

Special thanks to field staff Wally Kost, Ed Beveridge and Bob Oliver for their extended efforts during this prolonged damage season. I thank Bert Poston (Canadian Wildlife Service) for his critical review of this report and for providing data for Federal operations at Last Mountain Lake. Thanks to George Duff (Maps by Duff) who prepared the figures and to Lois Koback for typing and collating the manuscript.

TABLE OF CONTENTS

	Page
Abstract	i
Acknowledgements	ii
List of Figures	iv
List of Tables	iv
List of Appendices	iv
1. INTRODUCTION	1
2. OVERVIEW	1
2.1 Agricultural Conditions	1
2.2 Program Areas	2
3. OPERATIONS AND COSTS	4
3.1 Permanent Lure Crops	4
3.1.1 Lure Crops Operated by Provincial Government	4
3.1.2 Lure Crops Operated by Federal Government	6
3.2 Temporary Lure Crops	6
3.3 Bait Stations	9
3.4 Scaring	11
3.5 Information and Education	11
3.6 Special Projects	13
3.6.1 Program Implementation by Operations Branch Staff	13
3.7 Research and Evaluation	15
3.8 Administration	15
3.8.1 Provincial Government	15
3.8.2 Federal Government	16
4. SUMMARY OF OPERATIONS	16
5. LITERATURE CITED	17

LIST OF FIGURES

		Page
Figure 1.	Crop damage control units and program regions, Saskatchewan, 1985	3

LIST OF TABLES

Table 1.	Physical and cost data for Saskatchewan permanent lure crops by area, 1985	5
Table 2.	Physical and cost data for Saskatchewan temporary lure crops, 1974-1985	8
Table 3.	Physical and cost data for Saskatchewan bait stations by area, 1985	10
Table 4.	Number and distribution of scare cannons by S.P.R.R. district, Saskatchewan, 1985	12
Table 5.	Estimated provincial and federal operating costs of Saskatchewan Crop Damage Control Program, 1985/86	14

LIST OF APPENDICES

Appendix 1.	Physical and cost data for Saskatchewan permanent lure crops by field, 1985	18
Appendix 2.	Contract farming rates for permanent lure crops, Saskatchewan, 1985	19
Appendix 3.	Physical and cost data for Saskatchewan temporary lure crops by field, 1985	20
Appendix 4.	Physical and cost data for Saskatchewan bait stations by site, 1985	21
Appendix 5.	Cost benefits of feeding salvage grain from permanent lure crops at bait stations ..	22

1. INTRODUCTION

A five year (1983/84 to 1987/88) Federal Provincial Agreement to cost share 50:50 a Waterfowl Damage Prevention Program was signed in March, 1984. The program was operated in Saskatchewan in 1985 and consisted of feeding waterfowl at lure crops and bait stations and providing scare cannons for free distribution to farmers.

Under terms of the Agreement a program committee was established consisting of Mike Gollop from Saskatchewan Parks and Renewable Resources (Wildlife Branch) and Bert Poston from Environment Canada (Canadian Wildlife Service). A program plan prepared by the Committee was approved by the Directors of both agencies in July 1985. The program plan identified specific program objectives to be implemented by both governments during the 1985/86 fiscal year.

This summary report addresses objectives of the program plan and identifies new efforts to improve program operation. Activities summarized in this report were implemented by the Provincial government unless specifically identified as operated by the Federal government.

2. OVERVIEW

2.1 Agricultural Conditions

The 1985 growing season in Saskatchewan was characterized by generally ideal conditions, except for a severe drought in the southwest, from approximately Moose Jaw to Leader.

By early August a near record harvest was predicted over most of the province. The exception again was in the southwest where by contrast, significant acreage was being worked up in light of widespread crop failures.

Temperatures turned unseasonably cool throughout the province

in mid-August. Mid-August through October was characterized by unsettled weather with cool temperatures and frequent precipitation. During this period harvest was frequently delayed for significant periods resulting in severe losses in crop yield and grade. A warm stable air mass in early November finally resulted in general harvest completion except in a few northern areas where some acreage remained out over winter.

Compensation claims data used to measure the severity and distribution of waterfowl damage are not yet available for 1985. Preliminary information indicate approximately 4,000 claims were filed, more than double the previous high of 1800 in 1978. Reported incidents of damage were widespread throughout the province. Harvest transect data from 14 CDC areas indicate that harvest was 80% completed 30 to 45 days later than normal. Early indications suggest that the overall cost of claims will be a record high, possibly in the range of $7-8,000,000 and that many claims will be registered from areas which do not normally experience severe damage.

2.2 Program Areas

Prevention techniques funded by this program were implemented by the Provincial government in 25 Crop Damage Control (CDC) units and by the Federal government in 2 units (Figure 1). Unit prevention planning and evaluation studies were conducted in 8 additional areas.

Activities in each area followed direction of the program plan with the following adjustments for unforeseeable circumstances of the season:

1) Prevention techniques were implemented in the Big Quill and Leaf Lake units.

2) Field studies were conducted in the Slough Creek, Stinking Lakes and Keg Lake areas (Figure 1).

3) Prevention techniques were not implemented in the Mt. Hope area although field studies were conducted.

1 Berube Lake*
2 Big Sucker Lake
3 Bradwell (undesignated-federal)
4 Chaplin Lake
5 Cheal Lake
6 Condie Reservoir*
7 Diefenbaker Lake*
8 Eyebrow Lake*
9 Foam Lake*
10 Fulton Flats*
11 Grill Lake*
12 Horseshoe Lake
13 Jackfish Lake
14 Last Mountain Lake (federal)*
15 Leaf Lake*
16 Little Quill Lake*
17 Luck Lake (undesignated)
18 Meadow Lake*
19 Mount Hope*
20 Nicolle Flats*
21 North Battleford*
22 Old Wives (undesignated)
23 Ponass Lake*
24 Ranch Lake*
25 Rankin Marsh*
26 Stalwart Marsh (federal)*
27 Street Lake*
28 Stump Lake*
29 Thunder Creek*
30 Tobin Lake*
31 Upper Whitesand*
32 Wascana Lake*
33 Waterhen Marsh*
34 Witchekan Lake*
35 Yorkton South*
36 Big Quill Lake*
37 Keg Lake
38 Slough Creek
39 Stinking Lake

* Indicates unit had an operating prevention site in 1985

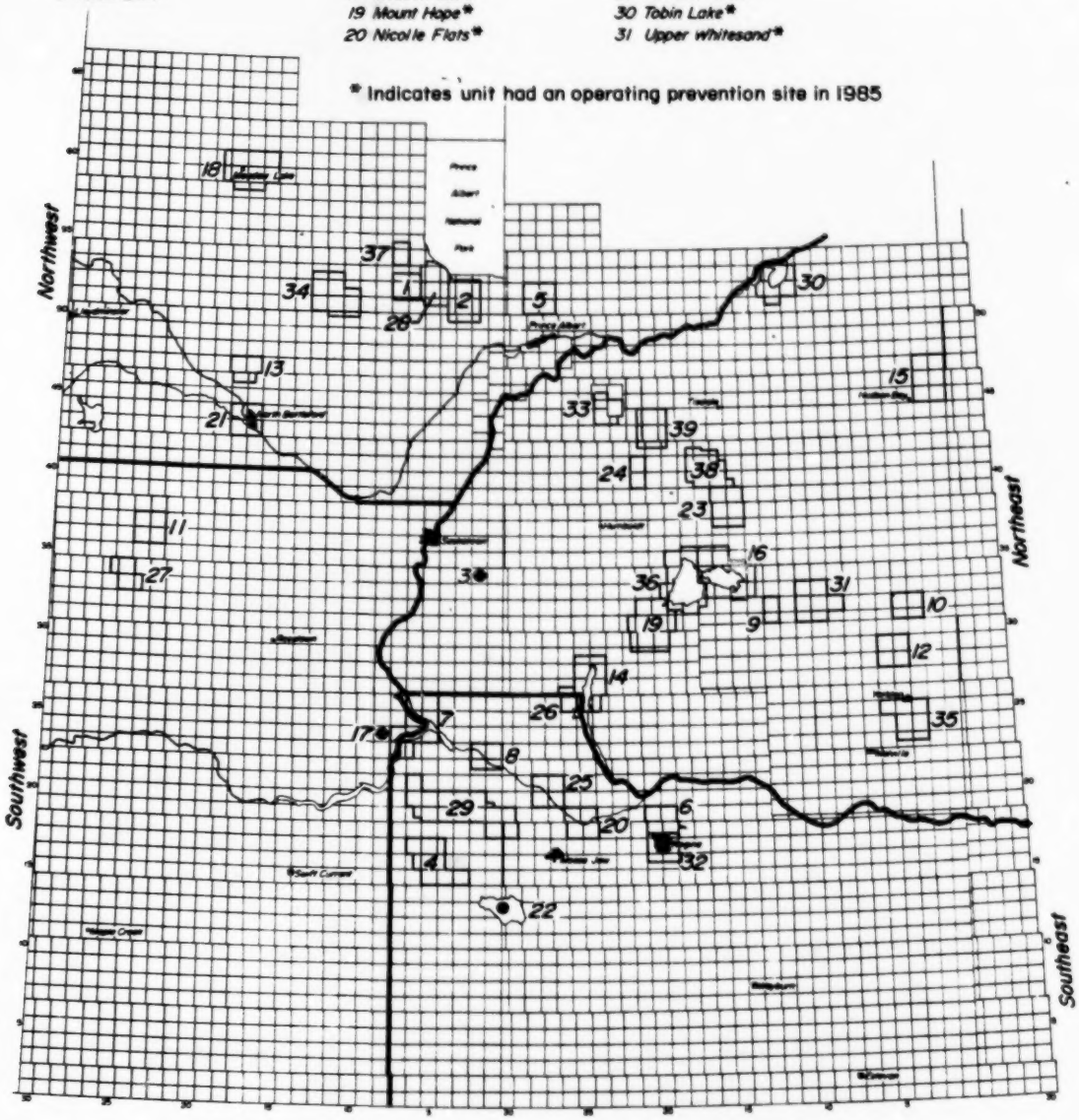


Figure 1. Crop damage control units and program regions, Saskatchewan, 1985.

4) No work was done in the Bradwell, Chaplin Lake, Cheal Lake and Old Wives areas.

3. OPERATIONS AND COSTS

3.1 Permanent Lure Crops

3.1.1 Lure Crops Operated by Provincial Government

There were 5,538 acres contract-farmed in 14 areas compared to 5,477 acres in 13 areas in 1984. The additional area was Leaf Lake where 140 acres were cultivated which could not be farmed last year due to flooding. An additional 160 acres were added to the existing acreage at Thunder Creek. A total of 196 acres were taken out of production at Tobin Lake and 43 acres at Foam Lake were not farmed due to high water levels. Location, acreage and cost data for permanent lure crops by area are shown in Table 1 and by field in Appendix 1. Contract farming rates are shown in Appendix 2.

Permanent lure crop cost data presented in Table 1 and Appendix 2 include all costs incurred to farm the land during the 1985 fiscal year. This differs from the calculation method of 1982-84 (Gollop 1983, 1985) where some costs against the current crop were carried over from the previous year and where some current costs were extended against the next year's crop. Also, in this report the cost/seeded acre after salvage includes the cost of summerfallow. The current method means that costs presented in the tables are the same as appear in the fiscal year-end invoice. Including summerfallow costs against the seeded acreage provides a more realistic comparison between areas using summerfallow rotation and those using continuous cropping procedures. However, to accurately determine the costs of farming any particular area requires averaging several years data to account for the dynamics of cost-carryovers.

The total 1985 operating cost of permanent lure crops was $155,772 or $54.41/seeded acre. Costs before salvage were $147,256

Table 1. Physical and Cost Data for Saskatchewan Permanent Lure Crops by Area, 1985.

Area	Acres			Total Cost ($)		Cost/Seeded Acre ($)		Grain Salvaged			Peak Waterfowl Counts[1]		
									Bushels Salvaged				
	Summer-Fallow	Seed	Total	Before Salvage	After Salvage	Before Salvage	After Salvage	Acres Harvested	Bait Sites	Private Sale	Date	Species	Number
Operated by Provincial Gov't.													
Condie	50	50	100	2627	3141	52.54	62.82	30	700	-			
Diefenbaker Lake	581	574	1155	23260	23710	40.52	41.31	30	600	-			
Eyebrow Lake	445	369	814	15405	15405	41.75	41.75	-	-	-			
Foam Lake	-	286	286	18762	20914	65.60	73.13	140	650	-	Sept 13	Cranes	4850
											Sept 25	Ducks	12500[2]
Leaf Lake	140	-	140	2985	2985	-	-	-	-	-			
Nicolle Flats	60	60	120	2394	2394	39.90	39.90	-	-	-			
North Battleford	20	20	40	1063	1063	53.15	53.15	-	-	-			
Ponass Lake	50	205	255	12241	17060	59.71	83.22	205	9400	-			
Rankin Marsh	60	60	120	1881	1881	31.35	31.35	-	-	-			
Street Lake	58	57	115	2595	2595	45.53	45.53	-	-	-			
Thunder Creek	260	120	380	5102	5102	42.52	42.52	-	-	-			
Tobin Lake	801	737	1538	46988	46988	63.76	63.76	-	-	-			
Wascana Lake	50	50	100	3018	3018	60.36	60.36	-	-	-			
Waterhen Lake	100	275	375	8935	9516	32.49	34.60	35	705	-			
Total of Provincial Operated Lure Crops	2675	2863	5538	147256	155772	51.43	54.41	440	12055	-			
Operated by Federal Gov't.													
Last Mountain Lake	730	850	1640	33765	33765	39.72	39.72	-	-	-			
Stalwart Marsh	80	80	160	2666	2666	33.33	33.33	-	-	-			
Total of Federal Operated Lure Crops	870	930	1800	36431	36431	39.17	39.17	-	-	-			

1 Counts were made at irregular intervals. The data presented is not necessarily indicative of actual maximum numbers using the site during peak periods.

2 Additional 12,500 at Bait Station.

or $51.43/seeded acre. A total of 440 acres of lure crop were harvested and produced 12,055 bushels (27.4 bushels/acre); 10,105 bushels were fed on bait sites and 1,850 bushels were placed in storage for 1986. Harvesting operations cost $8,516 or $0.71/bushel salvaged.

The prolonged harvest resulted in high utilization of permanent lure crops by waterfowl and correspondingly small amounts of salvagable grain. Of the 12,055 bushels salvaged 78% came from Ponass Lake where it was practical to combine damp grain since only short term storage was required before using the grain on immediately adjacent bait sites. The remaining 22% of salvage from other areas was from unutilized acreage remaining at the end of the depredation season. A cost benefit analysis of feeding salvage grain from permanent lure crops at bait stations is presented in Appendix 5.

3.1.2 Lure Crops Operated by Federal Government

Canadian Wildlife Service supervised operations on 1,640 acres of lure crop at Last Mountain Lake and 160 acres at Stalwart Marsh (Figure 1). Total farming costs for the 22 fields farmed under 9 contracts were $36,431 or $42.86/seeded acre.

The lure crops were seeded late in May at later dates than usual. Crops grew well and were swathed at the usual time in August. Lure crop use by waterfowl was moderate to heavy throughout the fall and no grain was salvaged from the lure crops.

3.2 Temporary Lure Crops

There are two categories of agreement to acquire temporary lure crops: 1) "complete agreement" - where the entire crop is purchased and left out for the duration of the damage season, 2) "compensation agreement" - where the crop is harvested as soon as possible and losses incurred prior to combining are covered by the program. Five temporary lure crops were agreed to in 1985, two complete and three compensation. Two lure crops were located in the

Little Quill CDC unit, two in Upper Whitesand and one in Big Quill. Crop purchase in 1985 is compared to the period 1974-1984 in Table 2. Physical and cost data for the individual fields are presented in Appendix 3. Barley was grown on all temporary lure crops. Unusual market conditions resulted in a variable price rate being used with purchase costs per bushel ranging from 2.60 to 2.90 with a mean of $2.64.

There were 622 acres purchased compared to 690 acres projected in the Program Plan. The plan forecast 315 acres for Little Quill where 215 acres were actually purchased and 175 acres for Upper Whitesand compared to 307 acres purchased. The plan also forecast 200 acres for Mt. Hope and Yorkton South. Acreage was not purchased in these units but 100 acres were acquired in the Big Quill unit.

Purchase of temporary lure crops is tightly controlled. They are used only in high priority damage areas and include only fields of proven potential to hold birds. Harvest transects are conducted prior to purchase to ensure that sufficient crop is still vulnerable to justify acquiring the acreage.

The greatest advantage of this prevention method is its flexibility. When the technique is properly implemented it can have positive impacts. The biggest disadvantage on a broad scale is the inconsistency of results. To be effective, temporary lure crops are fields with known potential to hold birds. These fields will be amongst the first to receive depredation in most years. It is at this point that purchase is most effective but if harvest proceeds at a normal pace, cost benefits may be reduced since significant amounts of purchased grain will remain but will be unharvestable due to trampling and weathering. On the other hand where purchase is delayed until the severity of the damage season can be more clearly ascertained these first fields have been depleted or abandoned. By this time, feeding flocks are highly mobile and show reduced fidelity to feeding sites such that even purchasing fields where birds are actively feeding will not guarantee the sustained containment required for effective prevention.

Table 2. Physical and Cost Data for Saskatchewan Temporary Lure Crops, 1974-1985.

∞

Year	Number Areas	Number Fields	Number Acres Total	Mean No. Ac/Field	Bushels Consumed	Total Cost After Salvage	Mean Cost/Acre
1985	3	5	622	124	30003[1]	78,160.00[2]	$117.00[3]
1984	3	4	451	113	20482	51,444.70	114.00
1983	4	5	634	127	25907	55,936.68	88.00
1982	8	7	1055	132	39502	106,291.00	101.00
1981	9	9	897	100	34831	94,066.20	105.00
1980	11	13	1708	131	58680	146,869.70	86.00
1979	12	25	2554	102	83735	155,986.12	61.00
1978	16	30	2678	89	119195	231,206.80	86.00
1977	37	67	4095	73	173912	391,632.00	83.00
1976	18	39	2878	74	109348	250,141.50	87.00
1975	20	37	2878	78	91645	254,366.25	88.00
1974	10	22	1647	75	64555	213,618.00	130.00

1 Includes 2494 bushels over-baited.

2 Includes $5524 to purchase extra bushels for over-baiting.

3 Calculated from a total purchase price of $72,636 which does not include over-baiting costs.

Four of the five fields purchased in 1985 are targeted for purchase under the Heritage Marsh Agreement. Once these fields are acquired the future role of temporary lure crops will have to be carefully reviewed. The "compensation agreement" for purchasing temporary lure crop buffers some of the negative qualities of the method but may be seen as favouring specific individuals while providing insufficient benefits to neighbouring landowners.

3.3 Bait Stations

Nineteen bait stations were operated in 13 areas. In addition, routine commitments were made to supply grain for overwintering the Wascana Lake Canada goose flock. New sites were operated at Grill Lake, Tobin Lake and Leech Lake (Yorkton South unit). The price paid for barley from private sources was variable due to fluctuating supply. Cost per bushel averaged $2.48 (range $2.10 to $3.00) (physical and cost data are presented by area in Table 3 and by site in Appendix 4).

Cost calculation methods differ from the 1982-84 period (Gollop 1983, 1985) in that all costs incurred to purchase and ship grain in the current fiscal year have been applied against the total grain consumed this year. Previous calculations applied only costs incurred to purchase grain consumed in the current year against that year's operation. Costs to purchase grain placed in storage were then carried over and applied against the following year. The current method means that cost data in Table 3 and Appendix 4 are the same as indicated in the fiscal year cost summary (Table 5). However, to fully understand the cost of operating any particular site(s) requires averaging several years data to account for the dynamics of cost carry-overs.

There were 157,588 bushels consumed at the 19 sites compared with a previous high of 37,819 in 1983. Grain was obtained mostly by private purchase (66%), grain in storage from 1984 (24%) and salvage grain from the current year (10%). The 10% salvage from the current year compares to 48% in 1984 and 77% in 1983. Salvage grain fed totalled 15,056 bu; 10,105 from provincially-managed lure crop and

Table 3. Physical and Cost Data for Saskatchewan Bait Stations by Area, 1985.

Area	No. Sites	Number of Bushels Consumed				Operating Costs ($)			Cost/Bu Consumed	No. Bu. In Storage at Year End
		Storage and Private Purchase	Salvage	Total	Grain	Operators Wages	Equipment Rental	Total		
Berube Lake	1	6736	-	6736	12611	3045	195	15851	2.35	0
Foam Lake	1	4255	-	4255	-	2835	-	2835	0.67	650
Fulton Flats	1	2424	-	2424	4716	2835	-	7551	3.12	0
Grill Lake	1	4451	1640	6091	12353	2485	632	15470	2.54	300
Little Quill Lake	3	39361	3311	42672	80065	8540	3264	91869	2.13	450
Meadow Lake	1	7494	-	7494	14794	3080	-	17874	2.39	100
Ponass Lake	4	26259	9400	35659	51109	11480	1413	64002	1.74	1150
Ranch Lake	1	5902	-	5902	8832	2800	-	11632	1.97	0
Stump Lake	1	6736	-	6736	13263	3045	230	16538	2.46	200
Tobin Lake	1	5530	-	5530	14378	1575	-	15953	2.88	0
Upper Whitesand	1	6090	-	6090	14658	4340	-	18998	3.12	0
Witchekan Lake	1	9412	705	10117	19464	3010	79	22553	2.23	0
Yorkton South	2	16282	-	16282	42612	5565	246	48423	2.97	500
Total Bait Stations	19	140932	15056	155988	288855	54635	6059	349549	2.22	3350
Wascana Goose Flock		600	-	600	-	-	300	300	-	-
TOTAL		141532	15056	156588	288855	54635	6359	349849	-	-

4,951 supplied by Canadian Wildlife Service from grain in storage at Last Mountain Lake, St. Denis and Bradwell. There are 4,650 bushels in storage for 1986 compared to 38,300 at the beginning of the 1985 season.

Waterfowl counts at sites were on an irregular basis and not all sites were counted in 1985. The exception was at Yorkton South where the Unit Prevention Evaluation included regular site counts. The decrease in emphasis on site monitoring is the result of placing higher priority on researching new program areas and doing intensive evaluations of active units. This changed priority emphasis will continue to direct program staff activities in the future.

New site construction, bin purchase and site operations closely followed projections of the Program Plan. However, operation cost forecasts were greatly exceeded due to the unusually late harvest. The grain bin for Yorkton South was provided by Ducks Unlimited resulting in a saving from estimated program costs.

3.4 Scaring

No new cannons were purchased for the program in 1985. Cannon repair was conducted by program staff using parts and tolls on inventory from previous years. Costs of $538 were restricted to authorized emergency repairs by commercial dealers.

The scare cannon inventory was updated by program staff prior to transferring direct control to the Property Control Branch of SPRR. Saskatchewan officially lists cannons as follows: 799 Zon II, and 51 Double Johns. This includes 414 Zon II's purchased as joint property under this program. The remaining guns were purchased by Ducks Unlimited under the Heritage Marsh Agreement. The distribution of this inventory is presented in Table 4.

3.5 Information and Education

All information disseminated under this program acknowledged joint funding by both governments. A video film was prepared demon-

Table 4. Number and Distribution of Scare Cannons by S.P.R.R. District, Saskatchewan, 1985.

District/Region	ZON II			Purivox Double John		Smith-Rolles[1]	Total
	Yellow[1]	Green[2]	Subtotal	Stationary[2]	Carousel[2]		
Carrot River	10	0	10	2	0	0	12
Greenwater	3	3	6	0	0	1*	7(1*)
Hudson Bay East	3	0	3	0	0	0	3
Hudson Bay North	0	0	0	0	0	0	0
Hudson Bay South	0	0	0	0	0	0	0
Mistatim	15	1	16	0	0	0	16
Pelly	20	0	20	0	0	0	20
Preeceville	4	5	9	1	0	0	10
Hudson Bay Region	55	9	64	3	0	1*	67(1*)
Dorintish	3	3	6	0	0	0	6
Pierceland	0	3	3	0	0	0	3
Glaslyn	8	5	13	1	0	0	14
Green Lake	0	0	0	0	0	0	0
Loon Lake	3	3	6	0	0	0	6
Meadow Lake	13	0	13	2	0	0	15
Spiritwood	9	3	12	2	0	0	14
Meadow Lake Region	36	17	53	5	0	0	58
Duck Mountain	2	1	3	0	0	0	3
Estevan	14	2	16	1	0	0	17
Melville	2	3	5	0	0	0	5
Moose Mountain	6	2	8	0	0	0	8
Moosomin	4	0	4	0	0	0	4
Yorkton	4	5	9	3	0	0	12
Melville Region	32	13	45	4	0	0	49
Big River	8	32	40	0	0	0	40
Candle Lake	5	3	8	0	0	0	8
Christopher Lake	0	0	0	0	0	0	0
Melfort	10	28	38	0	0	0	38
Nipawin	2	5	7	0	0	0	7
Prince Albert	5	45	50	0	0	0	50
Prince Albert Region	30	113	143	0	0	0	143
Assiniboia	23	3	26	0	0	0	26
Fort Qu'Appelle	13(2*)	0	13(2*)	0	0	0	13(2*)
Moose Jaw	10	4	14	0	0	0	14
Regina	12	0	12	2	0	0	14
Rowan's Ravine	15	16	31	15	0	0	46
Wadena	47	59	106	2	5	0	113
Regina Region	120	82	202(2*)	19	5	0	226(2*)
Battlefords Park	10	3	13	2	0	0	15
Blackstrap	8	5	13	0	0	0	13
Cutbank	19	0	19	11	0	0	30
Humboldt	16	30	46	0	0	0	46
Lloydminster	4	28	32	0	0	0	32
North Battleford	11	23	34	1	0	0	35
Pike Lake	5	0	5	0	0	0	5
Saskatoon	8	32	40	0	0	0	40
Saskatoon Region	81	121	202	14	0	0	216
Cypress Hills	2	0	2	0	0	0	2
Kindersley	30	20	50	0	0	0	50
Maple Creek	8	5	13	0	0	0	13
Shaunavon	0	0	0	0	0	0	0
Swift Current (Sask. Landing)	20	5	25	1	0	0	26
Swift Current Region	60	30	90	1	0	0	91
TOTAL	414(2*)	385	799(2*)	46	5	(1*)	850(3*)

1 Purchased under the Waterfowl Crop Damage Prevention Agreement except as noted (*).

2 Purchased under the Heritage Marsh Agreement.

* Owned by region.

strating the various aspects of program delivery. Total cost to produce the video was $4,173. Copies have been made and distributed to SPRR regional offices, Ducks Unlimited and Canadian Wildlife Service.

Draft guidelines for managing all phases of permanent lure crop and bait station operations have been prepared and a manual outlining basic scare cannon repair and maintenance procedures is in preparation. These will be finalized early in the 1986 fiscal year and the package distributed to SPRR regional offices to assist officers with newly delegated and continuing responsibilities for certain program operations.

This 1985 Summary Report has been prepared in accordance with terms identified in the co-operative Agreement.

No project signs were purchased due to the large expenditures incurred to operate the bait stations.

Cost inputs for many of the information initiatives undertaken are still ongoing although itemized final estimates are presented in Table 5. The total Information and Education budget forecast in the Program Plan was $13,100 compared to an estimated actual expenditure of $8,517.

3.6 Special Projects

3.6.1 Program Implementation by Operations Branch Staff

It was identified in the Program Plan to have Operations Branch staff assume management responsibility for bait stations and scare cannons in addition to their existing responsibilities for permanent lure crops. The objective is to have Operations assume these new duties in 1986/87. Initiatives towards this objective in 1985 included preparation of procedure manuals (Section 3.5) and a pilot project wherein Conservation Officers from North Battleford managed operation of the Grill Lake bait station.

It is anticipated that preparations for meeting the overall objective will be completed by July 1986. Actual costs associated

Table 5. Estimated Provincial and Federal Operating Costs of Saskatchewan Crop Damage Control Program, 1985/86.

Operating Expenses	Projected Cost From Program Plan	Invoice A (to February 1, 1986)	Estimate of Invoice B	Estimated Total (A + B)
Provincial Operating Costs				
Permanent Lure Crops	$195,897	$156,743[1]	$ 1,950[2]	$158,693
Temporary Lure Crops	74,520	78,160	0	78,160
Bait Stations				
Site Construction	7,000	3,425	0	3,425
Site Maintenance	1,400	1,576	0	1,576
Operator's Wages	25,080	54,635	0	54,635
Grain Hauling	3,325	5,788	0	5,788
Equipment Rental	0	570	0	570
Grain Purchase	50,400	288,855	0	288,855
Bin Purchase	5,400	3,637	0	3,637
Bait Station Total	92,605	358,486	0	358,486
Scaring (parts and repairs)	500	538	0	538
Information and Education				
Information Pamphlet	5,000	0	0	0
Video Production	1,000	4,173	0	4,173
Audio Visual Supplies	250	211	0	211
Audio Visual Processing	350	65	0	65
Drafting	2,500	3,068	1,000	4,068
Printing and Publishing Costs	1,000	0	0	0
Signs	3,000	0	0	0
Information and Education Total	13,100	7,517	1,000	8,517
Research and Evaluation				
Rent of Aircraft	5,000	10,428	0	10,428
Misc. Contractual Services				
Tobin Lake	3,000	8,097	0	8,097
Compensation Data	2,150	260	0	260
Maps and Air Photos	1,000	1,300	100	1,400
Spotting Scope	300	342	0	342
Research and Evaluation Total	11,450	20,427	100	20,527
Other Expenses	3,175	1,226	1,100	2,326
Administration				
Salaries	71,200	67,152	11,378	78,530
Sustenance and Lodging	9,196	9,473	200	9,673
Vehicle Rental	22,258	19,054	500	19,554
Telephone	6,000	5,419	200	5,619
Administration Total	108,654	101,098	12,278	113,376
Total Provincial Operating Costs	499,901	724,195	16,428	740,623
Federal Operating Costs				
Permanent Lure Crops				
Contracts	38,910	36,431	0	36,431
Grain Hauling	4,400	0	0	0
Permanent Lure Crop Total	43,310	36,431	0	36,431
Research and Evaluation	8,000	1,915	500	2,415
Other Expenses	250	89	0	89
Administration				
Salaries	14,550	14,662	0	14,662
Sustenance and Lodging	2,500	1,403	200	1,603
Vehicle Rental	2,154	1,436	0	1,436
Telephone	250	250	0	250
Administration Total	19,454	17,751	200	17,951
Total Federal Operating Costs	71,014	56,186	700	56,886
Total Federal and Provincial Operating Costs	570,915	780,381	17,128	797,509

1 Includes $972 for land taxes.

2 Remainder of land taxes

with this objective are covered under the Information and Education and Administration budgets.

3.7 Research and Evaluation

Research and Evaluation objectives were identified under Special Projects in the Program Plan. Methodology for conducting Area Prevention Plans and Unit Prevention Evaluations were tested in eight areas in 1985: Witchekan Lake, Keg Lake, Big Sucker Lake, Jackfish Lake, Stinking Lakes, Slough Creek, Horseshoe Lake and Yorkton South. Aerial surveys were conducted in 8 additional areas: Big Quill, Little Quill, Mt. Hope, Thunder Creek West, Luck Lake, Leaf Lake, Tobin Lake, and Upper Whitesand. Work identified in the Program Plan for Chaplin Lake and Ranch Lake was postponed due to low water conditions.

A summary of objectives and methods for conducting Area Prevention Plans and Unit Prevention Evaluations is in preparation as part of an upcoming report on program research and evaluation. Research and evaluation costs in the Program Plan (under Special Projects) were forecast at $11,450 with actual final costs now estimated at $20,427 (Table 5). This overrun was largely a result of the need for a more intensive aerial survey program than was initially identified.

3.8 Administration

3.8.1 Provincial Government

Staffing and responsibilities followed the Program Plan except the seasonal technician was filled by Ed Beveridge and the term was extended to five months from four due to the unusually prolonged operating period. The remaining positions, unchanged from the Program Plan were as follows: Program Co-ordinator (12 months), Mike Gollop; Program Technician (12 months), Wally Kost; Problem Wildlife Ecologist (3 months), Bob Oliver; Clerk Typist (5 months), Lois Koback. A total of 37 months were charged to the program, an increase of one month from the Program Plan but a decrease of 7 months from 1984.

Staff support costs including vehicles, sustenance, lodging and telephones were estimated at $37,454 in the Program Plan with actual final costs now estimated at $34,846.

3.8.2 Federal Government

Staffing and responsibilities followed the Program Plan: Program Co-ordinator (2 months), Bert Poston; Program Operator for Last Mountain Lake (4 months), Lyle Ludwig. Support costs were estimated at $4,904 compared to $3,378 currently estimated.

4. SUMMARY OF OPERATIONS

Program activities summarized in this report are cost shared 50:50 under a five year (1983-84 to 1987/88) Federal-Provincial Waterfowl Damage Prevention Agreement.

Lure crops and/or bait stations were operated in 27 Crop Damage Control Units in 1985, an increase of 5 from 1984.

The Provincial government managed 5,538 acres of permanent lure crop farmed in 14 CDC units and the Federal government managed 1,800 acres in 2 CDC units. Total cost of provincially-managed crops was $155,772 or $54.41/seeded acre after salvage. The federally-managed crops cost $36,431 or $42.86/seeded acre after salvage. A total of 440 acres of lure crop were harvested and produced 12,055 bushels (27.4 bushels/acre).

Five temporary lure crops totalling 622 acres were purchased in 3 CDC units. Total purchase cost was $72,636.

Grain consumed at bait sites was 157,588 bushels on 19 sites operated in 13 areas. New sites were operated at Grill Lake, Tobin Lake and Leech Lake in the Yorkton South Unit. Grain salvaged from lure crops accounted for 10% of the total grain fed. Mean purchase cost per bushel from private sources was $2.48.

No scare cannons were purchased in 1985.

Area Prevention Plans were concluded in five areas and initiated in two others. Unit Prevention Evaluations were conducted in one CDC unit. Preliminary plans and evaluations were conducted in an additional eight areas.

5.0 LITERATURE CITED

Gollop, M. A. 1983. Saskatchewan Waterfowl Crop Damage Control Program. Summary Report 1982. Unpubl. Manuscript. SPRR, Wildlife Branch, Saskatoon.

Gollop, M. A. 1985. Saskatchewan Waterfowl Crop Damage Control Program. Summary Report 1983 and 1984. Wildlife Tech. Report 85-1. SPRR, Wildlife Branch, Saskatoon.

Appendix 1. Physical and Cost Data for Saskatchewan Permanent Lure Crops by Field, 1985.

Area/Name	Land Location	Operation Dates			Acres			Crop Type	Total Cost		Cost/Seeded Acre		Grain Salvaged		
		Seed	Swath	Combine	SF	Seed	Total		Before Salvage	After Salvage	Before Salvage	After Salvage	Acres Harvested	Bushels Salvaged Bait Sites	Bushels Salvaged Private Sale
COWDIE															
E. English	SW32, SW33-18-20-W2	May 16	Aug 23	Oct 23	50	50	100	D	2627	3141	52.54	62.82	30	700	-
DIEFENBAKER															
B. Book	SW34-25-6-W3 E½ 4-26-6-W3	May 8	Aug 24	Oct 25	105	108	213	B	4391	4841	40.66	44.82	30	600	-
K. Book	NE32-24-5-W3	May 20	Aug 22	-	50	49	99	B	1849	1849	37.73	-	-	-	-
J. Forrest	E½ 17-26-6-W3	May 20	Aug 15	-	78	73	151	B	3466	3466	47.43	-	-	-	-
E. Hritzuk	W½ 9-26-6-W3	May 24	Aug 19	-	50	50	100	B	2659	2659	53.18	-	-	-	-
A. Long	W½ 28-24-5-W3	May 23	Aug 15	-	105	105	210	B	3486	3486	33.20	-	-	-	-
R. Long	E½ 26-24-5-W3	May 14	Aug 25	-	50	46	96	B	1501	1501	32.63	-	-	-	-
K. South	SE10-24-6-W3	May 13	Aug 13	-	78	77	155	B	3144	3144	40.83	-	-	-	-
R. Weigetz	S½ 1-24-7-W3	May 8	Aug 3	-	65	66	131	B	2764	2764	41.88	-	-	-	-
	Diefenbaker Lake Totals				581	574	1155		23260	23710	40.52	41.31	30	600	-
EYEBROW															
R. Moore	W½ 35-22-2-W3	May 9	Aug 19	-	125	128	253	B	5622	5622	43.92	-	-	-	-
F. Perlett	E½ 35, all 36-22-2-W3 S½ 2-23-2-W3	May 12	Aug 20	-	320	241	561	B	9783	9783	40.59	-	-	-	-
	Eyebrow Lake Totals				445	369	814		15405	15405	41.75	-	-	-	-
FOAM LAKE															
Joe Helgason	NW26, E½ 27, SE34-31-12-W2	May 17	Sept 10	Oct 30	-	286	286	B	18762	20914	65.60	73.13	140	650	-
LEAF LAKE															
W. Van Nes	SE18-46-1-W2	-	-	-	140	-	140	-	2985	2985	-	-	-	-	-
NICOLLE FLATS															
D. Nicolle	Ptn 36-18-25-W2 Ptn W½ 31-18-24-W2	May 8	July 25	-	60	60	120	B	2394	2394	39.90	-	-	-	-
NORTH BATTLEFORD															
T. Tkatchuk	S½ 7-44-16-W2	May 25	Aug 23	-	20	20	40	B	1063	1063	53.15	-	-	-	-
PONASS LAKE															
J. Dubreuil	NE24-38-15-W2	May 24	Sept 5	Oct 30	-	55	55	B	3781	4686	68.75	85.20	55	1100	-
J. Marshall	W½ 9-38-15-W2	May 29	Aug 20	Oct 1	50	150	200	B	9460	12374	63.07	82.49	150	8300	-
	Ponass Lake Totals				50	205	255		12241	17060	59.71	83.22	205	9400	-
RANKIN MARSH															
D. Bennett	Ptns 9-21-27-W2	May 15	Aug 7	-	60	60	120	B	1881	1881	31.35	-	-	-	-
STREET LAKE															
B. Balanoff	NW29-33-24-W3	May 9	Aug 23	-	58	57	115	B	2595	2595	45.53	-	-	-	-
THUNDER CREEK															
D. Dreger	S½ 4-19-1-W3	May 8	Aug 14	-	195	120	315	B	4370	4370	36.42	-	-	-	-
L. Eastmond	SW36-18-1-W3	-	-	-	65	-	65	-	732	732	-	-	-	-	-
	Thunder Creek Totals				260	120	330		5102	5102	42.52	-	-	-	-
TOBIN LAKE															
V. Baraniski	S½ & NW21, W½ & NE22-52-11-W2	June 13 Sept 12	Sept 13 Aug 19	- -	215 -	100 50	315 50	B WW	11514	11514	76.76	-	-	-	-
R. Flowerday	NE16-52-11-W2	May 24	Sept 3	-	30	34	64	B	2392	2392	70.35	-	-	-	-
S. Maxwell	SE23, W½ & NE24, SE25-52-11-W2	June 6	Sept 7	-	115	115	230	B	5677	5677	49.37	-	-	-	-
R. Morris	NE15-52-11-W2	June 22	Oct 13	-	-	57	57	B	2691	2691	47.21	-	-	-	-
K. Ratzlaff	NW4, E½ & SW9-53-10-W2	June 7	Sept 9	-	70	90	160	B	6122	6122	68.02	-	-	-	-
W. Senkow	NW15, S½ 22, SW23-52-11-W2	June 15	Sept 10	-	142	122	264	B	8073	8073	66.17	-	-	-	-
J. Sinclair	N½ 32-52-10-W2 SE5-53-10-W2	June 11	Sept 3	-	36	37	73	B	1930	1930	52.38	-	-	-	-
B. Weighill	NW10, E½ & SW15, E½ 22-53-10-W2	June 11	Sept 5	-	153	132	285	B	7741	7741	58.64	-	-	-	-
W. Wolowski	SW30-52-10-W2	-	-	-	40	-	40	-	840	840	-	-	-	-	-
	Tobin Lake Totals				801	737	1538		46988	46988	63.76	-	-	-	-
WASCANA LAKE															
Wascana Centre Authority	SE8-...-19-W2	May 15	Aug 24	-	50	50	100	B	3018	3018	60.36	-	-	-	-
WATERHEN															
B. Porter	NW18, NE19, E½ 30-44-21-W2 E½, SW-19-44-22-W2	May 23	Sept 17	Oct 28	100	275	375	B	8935	9516	32.49	34.60	35	705	-
TOTALS					2675	2863	5538		147256	155772	51.43	54.41	440	12055	-

1 B Barley D Durum Wheat WW Winter Wheat

Appendix 2. Contract Farming Rates for Permanent Lure Crops, Saskatchewan, 1985.

Operation	Rate Per Acre		
	1985	1984	1981
Seeding (including fertilizer application)	$ 7.00	$ 5.25	$ 4.40
Seeding-Cultivating (single operation)	9.00	-	-
Cultivating (summerfallow and pre-tillage)	3.75	3.30	3.30
Cultivating with Discer	5.40	-	-
Harrowing	2.00	1.75	1.40
Cultivating-Harrowing (single operation)	4.75	-	-
Harrowing-Packing (single operation)	3.80	-	-
Spraying (weed or pest control)	2.45	2.00	2.00
Swathing	5.70	4.40	3.50
Combining	15.00	20.00	17.00

Appendix 3. Physical and Cost Data for Saskatchewan Temporary Lure Crops by Field, 1985.

Area	Landowner	Land Location	Agreement[1]	Acres	Bushels Consumed[2]			Total Cost After Salvage		Peak Waterfowl Counts[3]		
					Initial	Over-baited	Total	Before Baiting	After Baiting	Date	Species	Number
Big Quill Lake	R. C. Laybourne	E½ 10-35-18-W2	Compensation	100	3710	-	3710	10759	10759	Sept. 26	Arctic Geese	3015
										Sept. 26	Cranes	250
Little Quill Lake	N. Arngrimson	N½ 30-33-14-W2	Compensation	5	105	-	105	273	273			
	J. Evans	N½ 9-35-15-W2	Complete	210	9450	1319	10769	24570	27156	Sept. 6	Lg. Canadas	1000
										Sept. 6	Cranes	4148
Upper Whitesand	H. Fogg	SE34, SW35-32-9-W2	Compensation	75	4500	1175	5675	11700	14638	Sept. 18	Ducks	7750
										Sept. 18	Lg. Canadas	400
	R. Prouse	NW26, NE27, SE34-31-9-W2	Complete	232	9744	-	9744	25334	25334			
TOTALS				622	27509	2494	30003	72636	78160			

1 Compensation - crop is harvested as early as possible and losses incurred prior to combining are covered; Complete - entire crop is purchased and left out through season.

2 All fields were seeded to barley.

3 Counts were made at irregular intervals. The data do not necessarily indicate maximum numbers using the site during peak periods.

Appendix 4. Physical and Cost Data for Saskatchewan Bait Stations by Site, 1985.

Area/Site	Land Location	Period of Operation		Operator	Grain Consumed			Private Contributors	Costs ($)				Cost/Bu Consumed	Peak Duck Count[1]	
		Dates	Days		Storage & Private Purchase	Salvage	Total		Grain	Wages	Equip. Rental	Total		Date	Number
Berube Lake	SW15-52-7-W3	Aug 3 - Oct 29	37	E. Collins	6736	-	6736	2	12611	3045	195	15851	2.35	Oct 21	22000
Foam Lake	SW34-31-12-W2	Aug 5 - Oct 24	81	C. Patterson	4255	-	4255	0	-	2835	-	2835	0.67	Sept 25	12500
Fulton Flats	SW18-32-3-W2	July 15 - Oct 22	100	D & J Swetleshnoff	2424	-	2424	2	4716	2835	-	7551	3.12	Oct 2	2355
Grill Lake	SE31-37-22-W3	Aug 6 - Oct 15	71	F. Dresser	4451	1640	6091	2	12353	2485	632	15470	2.54	Oct 21	17000
Little Quill															
Milligan	NE10-34-14-W2	Aug 7 - Oct 24	79	H. Halverson	7136	2252	9388	3	17692	2765	2180	22645	2.41	Sept 4	8200
Mud	SE27-34-16-W2	July 15 - Oct 24	102	F. Weigel	11950	-	11950	2	26937	2940	-	29877	2.50	Sept 6	21500
West	SE5-35-15-W2	Aug 5 - Oct 24	81	J. Evans	20275	1059	21334	7	35436	2835	1076	39347	1.84	-	-
	Little Quill Total				39361	3311	42672	12	80065	8540	3264	91869	2.15		
Meadow Lake	SW10-59-16-W3	Aug 4 - Oct 31	88	N. Danilkewich	7494	-	7494	3	14794	3080	-	17874	2.39	Oct 30	28000
Ponass Lake															
North	NE24-38-15-W2	Aug 5 - Oct 25	82	J. Dubreuil	3755	1100	4855	3	10620	2870	-	13490	2.78	-	-
South	NE1-38-15-W2	Aug 5 - Oct 25	82	W. Harrison	3970	-	8970	2	10217	2870	538	13625	1.52	-	-
Stanges	W½ 9-38-15-W2	Aug 5 - Oct 25	82	N. Marshall	6467	4150	10617	3	16216	2870	437	19523	1.84	-	-
West	NE14-38-15-W2	Aug 5 - Oct 25	82	N. Marshall	7067	4150	11217	3	14056	2870	438	17364	1.55	-	-
	Ponass Lake Total				26259	9400	35659	11	51109	11480	1413	64002	1.79		
Ranch Lake	NE2-41-20-W2	Aug 5 - Oct 22	80	R. Nickeson	5902	-	5902	1	8832	2800	-	11632	1.97	Sept 19	9300
Stump Lake	NE8-53-5-W3	Aug 5 - Oct 31	87	H. Lehman	6736	-	6736	3	13263	3045	230	16538	2.46	Oct 17	23000
Tobin Lake	SW22-52-11-W2	Aug 5 - Nov 1	45	K. Baraniski	5530	-	5530	5	14378	1575	-	15953	2.88	Oct 9	7900
Upper Whitesand (Stonewall)	SW36-32-9-W2	July 15 - Oct 28	106	M. Scramstad H. Fogg	6090	-	6090	6	14658	4340	-	18998	3.12	Sept 25	6350
Witchekan Lk.	SE26-51-11-W2	Aug 6 - Oct 31	86	R. Ouellette	9412	705	10117	1	19464	3010	79	22553	2.23	Oct 22	30000
Yorkton South	NE9-24-4-W2														
Buckle (formerly Yorkton S.)	SW28-24-4-W2	July 15 - Oct 24	102	K. McLean	9574	-	9574	6	25055	3080	123	28258	2.95	Sept 16	12000
Leech		Aug 14 - Oct 23	71	K. Wolfe	6708	-	6708	5	17557	2485	123	20165	3.01	Oct 17	10500
	Yorkton South Total				16282	-	16282	11	42612	5565	246	48423	2.97		
Bait Station Totals					140932	15056	155983	59	288855	54635	6359	349549	2.24		
Wascana Goose Flock	Under agreement to supply grain for winter feeding				600	-	600		-	-	300	300	-		
TOTAL					141532	15056	156588	59	288855	54635	6359	349849	-		

1 Counts were made at irregular intervals. The data presented is not necessarily indicative of actual maximum numbers using the site during peak periods

Appendix 5. Cost Benefits of Feeding Salvage Grain From Permanent Lure Crops at Bait Stations

1. Background

Bait stations of current design were first operated in Saskatchewan in 1980 on an experimental basis and results monitored in 1980 and 1981 to determine application on a provincial scale. During this period drought conditions resulted in no waterfowl utilization of a lure crop at Street Lake. This acreage was subsequently combined and the grain was fed at bait stations on Little Quill and Ponass Lakes.

Prior to expanding the bait station system, salvage lure crop grain was traditionally combined and sold to the contract farmer or exchanged for a reduced payment for operations performed to grow the crop. Three lure crop areas, Diefenbaker Lake, Street Lake and Tobin Lake, had been identified as regularly having grain remaining unutilized after the depredation season. This recurrent under-utilization was interpreted as indicating that lure crop acreage could be reduced or eliminated in these areas. Existing plans to reduce acreage were curtailed when it was assumed that a cost benefit would be realized by using this salvage grain on bait stations.

Initially, the program had limited capacity to store grain over winter so it was imperative that grain be salvaged early enough to allow feeding in the current season. This tended to eliminate the usefulness of northern lure crops (eg. Tobin Lake) to supply grain and added further to the importance of the southern crops. Farming costs involved to produce the grain were significantly lower in southern areas and it was considered that these lower costs offset the normally smaller yields realized.

These initial conclusions essentially resulted in permanent lure crops being classified into two types according to their primary objectives. "Damage Prevention Crops" were those which were assumed in most years to be utilized by waterfowl during a period when these birds would otherwise be foraging in unharvested private fields. Crops

included in this type were considered necessary to maintaining effective prevention and on the basis of available data were thought to be achieving this objective.

"Grain Production Crops" were those identified as inadequate or unnecessary to cost-efficient damage prevention, and their role was solely or primarily to produce grain for bait stations.

How a lure crop is classified is fundamental to determining how the economic efficiency of that crop is evaluated. Economic benefit of Damage Prevention Crops is considered as the cost to operate the crop plus the estimated cost of unprevented damage versus the estimated cost of damage in lieu of any prevention effort. Economic benefit of Grain Production Crops is considered as the costs to raise, harvest and transport each bushel salvaged relative to the cost of purchase on the open market.

2. Methods of Analyses

This evaluation identifies the total costs of salvage grain from 1982 to 1985, compared to the potential cost through market purchase. Three methods were used to calculate total costs of salvage grain from each field:

1. Actual costs to combine the grain and haul it from the field to the elevator or bait station (primary hauling cost) plus a mean cost for secondary hauling. Costs for secondary hauling were those from a second elevator to a bait station. Secondary hauling costs were totalled for all locations and years, then divided by the number of bushels salvaged to generate a mean cost per bushel applied to all areas. A mean cost was used because grain from any one lure crop could be equally assigned for delivery to any bait station. Thus a mean probability for cost is considered more realistic than applying the actual secondary hauling costs incurred against any specific lure crop. It should be noted however that lure crops located adjacent to bait sites with storage facilities (eg. Ponass

Lake, Foam Lake) would rarely incur secondary hauling costs.

2. Actual farming costs to produce and harvest the salvaged grain. This was calculated for acres actually combined and was determined as follows: the total costs to produce the crop, - divided by the total seeded acres, - multiplied by the number of acres combined, - plus costs of combining and primary and secondary hauling as in (1).

3. Actual total costs to raise and harvest the entire acreage including acres which were not combined.

The total cost from each calculation method was divided by the number of salvage bushels produced to obtain a cost/bushel salvaged.

The cost per bushel from each calculation method was compared to the market cost per bushel to determine the benefit. A mean market cost per bushel, calculated from total costs of all market grain purchases from 1982-1985, was used primarily because not all grain was fed the year it was salvaged. Thus grain salvaged could have been replaced by market purchase over as many as three years in some cases. Use of a 'mean' also considers that market purchases could be concentrated during periods when grain prices are low, thereby maximizing the return on dollars spent.

Benefit was determined on the basis of the total bushels fed at bait stations or currently in storage, for each year from 1982-1985. The actual costs to obtain this volume were calculated for each year and for the four year period. Comparable costs to obtain that volume through market purchase were calculated using the mean cost per bushel for the period. The "benefit" resulting from use of salvage grain was the difference between the actual costs and calculated market purchase costs.

Cost-benefits for salvage by these cost calculation methods were derived from all areas by year, and for the period. Administrative costs of program staff and Conservation Officers were not included. Eyebrow Lake salvage data were excluded in the analyses since a crop-

share agreement to cover combining costs was used. This resulted in no records of harvested acreages and therefore comparable costs could not be calculated. Similarly, bushels and hauling costs for grain from Last Mountain Lake, St. Denis and Bradwell were excluded because no production or harvesting costs were available.

3. Grain Production Crops

All lure crops were initially selected to efficiently prevent waterfowl damage from birds originating on nearby wetlands. There were no Saskatchewan lure crops acquired or put into production for the primary purpose of producing grain. The Grain Production Crops considered in this evaluation therefore represent acreage which had not achieved its initial objective, determined in most cases by the recurrent presence of unutilized grain.

Areas with lure crop currently designated as Grain Production Crops are Street Lake (115 acres) and Diefenbaker Lake (1,155 acres). The remaining 4,268 acres in 12 areas are designated as Damage Prevention Crops to be retained subject to results of ongoing evaluation studies.

3.1 Diefenbaker Lake

The Diefenbaker lure crops, first operated in 1970, currently comprise 1,155 acres farmed under 8 operating contracts. All cursory field evaluations have concluded that the Diefenbaker crops receive little use by waterfowl early in the season when nearby private fields are vulnerable. Most of the lure crop acreage is consumed later in the season when most private acreage has been harvested. The acreage is well located for waterfowl use, and the observed utilization is explained by the relatively small numbers of waterfowl early in the season. In summary, large staging populations on Lake Diefenbaker appear too late in the fall to threaten private crops to the degree warranting the existing lure crop acreage for prevention purposes. However, as Grain Production Crops, Diefenbaker has supplied 38% of

salvage grain used at bait stations from 1982-1985.

3.2 Street Lake

The Grain Production Crop at Street Lake, first operated in 1974, has had an irregular history of use by waterfowl. It is well utilized when Street Lake has water in the fall and has been totally consumed in five of its twelve operational years. The remaining seven years the crop has been unutilized and the entire acreage harvested. That the lure crop was totally consumed on five occasions is assumed to indicate it was periodically efficient as a Damage Prevention Crop. Without field data it is not known whether the crop was used during periods when private fields were vulnerable. The field has been assigned as a Grain Production Crop on the basis of its inconsistent record in damage prevention. That is, as a damage prevention technique it is not efficient to pay the annual costs to produce a lure crop which is utilized in only five of 12 years.

4. Results and Discussion

4.1 Overall Cost Benefits

Data used to tabulate overall cost benefits are presented in Table 1. From 1982 through 1985 a total of 82,561 bushels were salvaged from 3,215 acres on 16 different fields in 8 different areas. The total cost to combine and transport this grain was $78,575 or $0.95 per bushel salvaged.

During this period when 234,284 bushels were fed or remained in storage at bait stations, salvage grain accounted for 35% of the total. The actual cost of this grain was $397,799 or $1.70 per bushel. Had the entire grain requirements been met through market purchase at $2.46 per bushel, the cost would have been $576,339. The difference of $178,540 represents the gross saving before input costs.

Subtracting the cost to harvest the grain, $78,575, the net benefit is $99,965 or $0.43 per bushel fed. The assumption in calcu-

Table 1. Cost Benefits of Salvaging Grain From Permanent Lure Crops, Saskatchewan, 1982-1985.[1]

Year	Permanent Lure Crops						Bait Stations				Cost Benefit			
	Acres Harvested	Bushels Salvaged	Total Costs		Cost Per Bushel ($)		Total Grain From Market Purchase	Total Grain[4] Consumed (bu)	Actual Cost of Total Grain Consumed ($)	Actual Cost/Bushel of Total Grain Consumed ($)	Potential Costs		Potential Benefit	
			Production & Harvesting[2] (A)	Harvesting[3] (B)	Production & Harvesting[2]	Harvesting[3]			(C)		Mean Cost/Bushel From Market Sources ($)	Calculated Cost to Purchase All Grain Consumed at Market Prices (D)	Comparing D to A + C	Comparing D to B + C
1982	628	23955	39463	17333	1.65	0.72	8023	13507	19656	1.46	2.46	33227	-25892	-3762
1983	1178	27799	76782	29694	2.76	1.07	15632	37819	34468	0.91	2.46	93035	-18215	+28873
1984	969	18752	71145	22947	3.79	1.22	19493	28086	49023	1.75	2.46	69092	-51076	-2878
1985	440	12055	34959	8601	2.90	0.71	118598	154072	294652	1.90	2.46	330985	+51374	+77732
Total	3215	82561	222349	78575	2.69	0.95	161746	234204	397799	1.70		576339	-43809	+99965
Mean											2.46			

1 Includes Grain Production and Damage Prevention Crops.
2 Costs calculated only for the actual acreage harvested. Includes $0.09 per bushel to cover costs of hauling grain from second elevator to bait site.
3 Includes $0.09 per bushel to cover costs of hauling grain from second elevator to bait site.
4 Excludes 9977 bu obtained from Canadian Wildlife Service and Eyebrow Lake but not included in cost calculations. Some 1985 grain is in storage for 1986.

lating benefit by this method is that it was essential to farm the acreage combined for a purpose other than obtaining salvage grain. If this assumption is invalid then it is necessary to include the costs to produce the crop on that acreage as well as to harvest the salvage. The total cost to produce and harvest the grain on the 3,215 acres salvaged from 1982-1985 was $222,349. This calculation method results in a negative benefit of $43,809 or $0.19 per bushel fed.

The overall cost benefit calculations in Table 1 include the pooled results from lure crops of each classification. The results suggest that there is a positive benefit to salvaging unutilized lure crop acreage once the crop has been grown. This would apply for any field where actual harvesting and hauling costs were less than or equal to commercial value of grain. However, when all crops are considered, a negative benefit is realized if the cost of raising the crop is included. Therefore, it is necessary to exclude the Damage Prevention Crops from the second calculation and to include only the Grain Production Crops.

4.2 Cost Benefit of Grain Production Crops

4.2.1 Diefenbaker Lake

Data used to tabulate cost benefits are presented in Table 2. A total of 31,511 bushels were salvaged from 1982 through 1985 when Diefenbaker crops accounted for 38% of provincial grain salvage. There were 2,313 acres seeded during this period of which 1,238 (54%) were harvested.

The cost to harvest the salvaged grain was $31,719. The cost to purchase the equivalent amount of grain from market sources would have been $77,517 indicating a positive cost-benefit of $45,798. When the costs to raise the crop on the 1,238 harvested acres is included a positive benefit of $5,014 is realized.

The Diefenbaker lure crops are currently designated as Grain Production Crops on the basis of data which suggest they are not required for damage prevention. If these data are correct then the sole objective in contracting farming operations at Diefenbaker Lake

Table 2. Cost Benefits of Salvaging Grain From Grain Production Crops, Saskatchewan, 1982-1985.

Year	Total Acres				Total Costs ($)			Cost/Bushel Salvaged ($)			Cost Benefit ($)				
											Potential Costs		Potential Benefits		
	Seeded	Harvested	Percent Harvested	Bushels Salvaged	Production & Harvesting on All Seeded Acres[1] (A)	Production & Harvesting on Harvested Acres[1] (B)	Harvesting[1] (C)	Production & Harvesting on All Seeded Acres[1]	Production & Harvesting on Harvested Acres[1]	Harvesting[1]	Mean Cost/Bushel From Market Sources	Calculated Cost to Purchase Equivalent Grain at Market Prices (D)	Comparing D to A	Comparing D to B	Comparing D to C
DIEFENBAKER LAKE															
1982	581	438	75	15755	31361	26917	12284	1.99	1.71	0.78	2.46	38757	+7396	-11840	+25473
1983	574	534	93	13252	31669	30621	13825	2.39	2.31	1.04	2.46	32600	+931	+1979	+18775
1984	584	236	40	1904	23511	13241	5106	12.35	6.95	2.68	2.46	4684	-18827	-8557	-422
1985	574	30	5	600	23611	1724	504	39.35	2.87	0.84	2.46	1476	-22135	-248	-972
Total	2313	1238	54	31511	110152	72503	31719	3.50	2.30	1.01	2.46	77517	-32635	+5014	+45798
STREET LAKE															
1982	58	58	100	2400	3586	3586	1398	1.49	1.49	0.58	2.46	5904	+2318	+2318	-4506
1983	57	57	100	1934	3056	3056	1612	1.58	1.58	0.83	2.46	4758	+1702	+1702	+3146
1984	53	58	120	771	3555	3555	1365	4.61	4.61	1.77	2.46	1897	-1658	-1658	+532
1985	57	0	0	0	2595	-	-	-	-	-	2.46	0	-2595	-	-
Total	230	173	75	5105	12792	10197	4375	2.51	2.00	0.86	2.46	12559	-233	+2362	+3184

1 Includes $0.09 per bushel to cover costs of hauling grain from second elevator to bait site.

is to obtain salvage grain. It is therefore necessary to include all costs for the total acreage in order to determine the true benefit. The total cost to farm the entire Diefenbaker acreage from 1982-1985 was $110,152. This includes the cost to salvage, plus the cost to produce the crop on both harvested and unharvested acreage. When this cost is used a negative benefit of $32,635 is realized.

From 1982-1985 there were 1,075 acres (46% of total acres seeded) which were not harvested. Although concrete data are lacking it is known that only a portion of this unharvested acreage was effective in preventing waterfowl damage. In 1984, a year of severe drought and grasshopper infestations, there were 236 acres (40% of total seeded) harvested and these produced 1,904 bushels or 8 bushels per acre. The remaining acreage had even less production and was not worth harvesting. Even in 1985 when harvest was extended and the waterfowl damage potential was high, reports suggest most harvest was completed before use of the lure crops became general (W. Kost, D. Rodway pers. comm.). Thus the analysis yielding the negative benefit appears the most applicable as a basis for future management decisions.

4.2.2 Street Lake

A total of 5,105 bushels were salvaged from 1982 through 1985 (Table 2). There were 230 acres seeded of which 173 (75%) were harvested.

The cost to harvest the salvaged grain was $4,375. The cost to purchase the equivalent amount at market prices would have been $12,559 indicating a positive cost benefit of $8,184. When the cost to produce the crop on the 173 harvested acres is included, a positive benefit of $2,362 is achieved. When the total costs to farm and salvage the entire 230 acres is considered a negative benefit of $233 results.

The Street Lake lure crop has been designated as a Grain Production Crop on the basis of its pattern of inconsistent use (consumed in 5 of 12 years). This usage pattern is directly related to water levels in the Street Lake basin. Detailed evaluation data

are lacking but reports suggest the field is valuable in preventing waterfowl damage during years when the basin has water in the fall. More detailed field work is required but on the basis of present information the analysis comparing cost to produce and harvest only the harvested acres compared to the cost of market purchase seems the most applicable. Additional acreage raised but not harvested has apparently been effective in achieving objectives of a Damage Prevention Crop. On this basis the field is demonstrating a positive benefit for grain production during the years in which the basin is dry and is assumed to be achieving a positive benefit for damage prevention in the remaining years.

4.3 Factors Affecting Cost-Benefit

4.3.1 Input Costs Versus Yield

A number of factors influence the cost benefit of salvaging lure crop grain. Costs to produce and harvest the grain are of primary importance in determining the input value while crop yield, as realized in bushels salvaged per acre harvested, and mean market value are the most important determinants of benefit. Additional costs such as hauling the grain to the bait site will vary according to the destination selected and in the present analysis a uniform cost ($0.09/bushel) has been assigned for all areas. Input costs, yields and market values by year and area are presented in Table 3.

The cost per bushel to purchase barley from private sources will ultimately determine cost benefit regardless of how input costs and yields are managed. By taking advantage of favourable market fluctuations the program can maximize returns on moneys spent in any two-three year period. These management techniques will not however, offset long term trends and as these trends cannot be adequately forecast, the results and discussion which follow assume the current market value ($2.46 per bushel) as a constant.

All areas where yields from salvaged acres exceeded 25 bushels demonstrated a positive cost-benefit regardless of production costs

Table 3. Input Costs and Cost-benefits of Salvage Grain for Permanent Lure Crops, Saskatchewan, 1982-1985.

Year	Acres Harvested	Bushels Salvaged	Yield/Acre Harvested (bu)	Costs/Acre Harvested[1]		Cost Per Bushel ($)		Benefit Per Bushel ($)			Break-Even Yield/Acre Harvested
				Production	Production & Harvesting	Production & Harvesting[2]	Harvesting[2]	Mean Cost Per Bushel From Market Sources	Production & Harvesting	Harvesting	
1982	628	23955	38.1	35.24	59.41	1.65	0.72	2.46	+0.81	+1.74	23.3
1983	1178	27799	23.6	39.97	63.06	2.76	1.07	2.46	-0.30	+1.39	26.5
1984	969	18752	19.4	50.04	71.68	3.79	1.22	2.46	-1.33	+1.24	33.1
1985	440	12055	27.4	59.90	76.99	2.90	0.71	2.46	-0.44	+1.75	39.7
Total	3215	82561	25.7	44.81	66.85	2.69	0.95	2.46	-0.23	+1.51	29.7
Area (1982-1985)						Grain Production Crops					
Diefenbaker	1238	31511	25.5	32.94	56.27	2.30	1.01	2.46	+0.16	+1.45	21.8
Street	173	5105	29.5	33.65	56.29	2.00	0.86	2.46	+0.46	+1.60	22.3
Sub Total	1411	36616	26.0	33.03	56.28	2.26	0.99	2.46	+0.20	+1.47	21.9
						Damage Prevention Crops					
Condie	80	1950	24.4	41.39	63.73	2.70	1.01	2.46	-0.24	+1.43	27.4
Foam Lake	665	8850	13.3	70.25	90.26	6.87	1.59	2.46	-4.41	+0.87	46.5
Nicolle Flats	140	2127	15.2	25.84	48.91	3.31	1.61	2.46	-0.85	+0.85	17.1
Ponass Lake	574	22970	40.0	57.50	78.86	2.06	0.62	2.46	+0.40	+1.84	38.1
Thunder Ck.	95	843	8.9	31.99	52.93	5.71	2.45	2.46	-3.25	-0.01	21.2
Waterhen	250	9205	36.8	31.10	54.17	1.56	0.72	2.46	+0.90	+0.90	20.6
Sub Total	1804	45945	25.5	54.02	75.12	3.04	0.92	2.46	-0.58	+1.54	35.8
TOTAL	3215	82561	25.7	44.81	66.85	2.69	0.95	2.46	-0.23	+1.51	29.7

1 Costs calculated only for the actual acreage harvested. Does not include costs of hauling from second elevator to bin.
2 Costs calculated only for the actual acreage harvested. Includes $0.09 per bushel to cover costs of hauling grain from second elevator to bait site.

(Table 3). Conversely, all areas with yields less than 25 bushels had negative cost benefits. Production costs were not predictably correlated with benefit; the two lowest production cost areas (Nicolle Flats and Thunder Creek) had negative cost-benefits while three of the four highest production cost areas had positive benefits (Table 3). This may be partly explained by the unique factors which affect lure crop situations. Higher production costs are generally incurred on heavier soils or in higher moisture areas where continual cropping is practised. These soils and areas would be expected to yield consistently higher than lighter soils or fields in drought-prone regions. Thus higher production costs should correlate to higher yields. While this correlation may be initially true on lure crop lands as well, the impact of foraging waterfowl often results in reduced yields prior to harvesting. This in turn negates the potential direct correlation between production costs and salvaged yield.

The results then indicate that yields in excess of 25 bushels salvaged per harvested acre were sufficient to offset production costs for the sample examined. In fact it is the relationship of yield to production and harvesting costs that determines whether a positive benefit is realized. Positive benefit will be realized when production and harvesting costs per harvested acre ÷ yield (bushels salvaged per acre) < mean market value - hauling costs per bushel salvaged. So a 25 bushel yield would not produce a positive cost benefit where input costs exceeded $59.25 per acre (market value $2.46 X 25 bushels less 25 bushels X .09 per bushel for hauling = $59.25).

4.3.2 Break-Even Yield Requirements

Yield is affected by cost of production and harvesting. A break-even yield is that required to make all input costs per bushel salvaged, equal to the cost per bushel at market price. Break-even yields for all years and areas are shown in Table 3. The data was calculated assuming a fixed cost of $0.95 per bushel to cover harvesting and secondary hauling, and a fixed market value of $2.46 per

bushel. The difference between these constants is $1.51 per bushel and production costs ÷ $1.51 determined the yield required to offset these costs.

Break-even yields ranged from 17.1 bushels per acre at Nicolle Flats where production costs were lowest to 46.5 bushels per acre at Foam Lake which had the highest production costs. More importantly, break-even yields are seen to be steadily increasing each year as production costs increase. The break-even yield required in 1985 was 39.7 bushels per acre from 23.3 bushels in 1982.

Knowing the break-even yield is important in managing existing lure crop acreage and determining future requirements. Existing crops where break-even yields are not being realized and where some acreage is consistently under-utilized should be reduced to the minimum acreage required to prevent waterfowl damage in a normal year. Acreage not utilized by waterfowl will have been produced at negative benefit in these areas.

The high break-even yield in 1985 (39.7 bushels/acre) and the trend for this figure to increase annually suggest that purchase of crop in new areas should be carefully limited to the acreage required to directly feed waterfowl. Acreage should not be acquired solely for the purpose of producing grain to harvest for feeding at secondary locations.

Using the current constant values for harvesting costs per bushel and market cost per bushel, break-even yields are presented for various production costs/acre below:

Production Cost/Acre	Break-Even Yield
$30	19.9
40	26.5
50	33.1
60	39.7
70	46.4
80	53.0
90	59.6
100	66.2

4.3.3 Discussion of Positive Benefit Areas

Areas with a positive benefit from the analysis of production plus harvesting costs were Diefenbaker, Street Lake, Ponass Lake and Waterhen. Diefenbaker and Street Lake were discussed in detail in Section 4.2.

Ponass Lake

The Ponass Lake area has two lure crops, each situated immediately adjacent to bait stations. Some yield is lost on both fields due to ducks foraging around the bait site but in most years overall yield is not significantly impacted. The Ponass Lake crops have relatively high production costs ($57.50/seeded acre) which are offset by consistently high yields (40 bushels salvaged/acre harvested). The crops provide needed back-up to the damage prevention facilitated by the bait stations. Also, crop lost to ducks at each field would have been eligible, if privately owned, for 100% compensation under the program policy to pay all damage within 400 meters of an active bait site. The proximity of the bait sites means that no secondary hauling costs are incurred and no interim storage is required. This in turn means grain can be harvested while still damp and piled in the open for use while the bait stations are operating.

It would appear that many of the advantages offered by the Ponass fields would accrue to any lure crop placed in such proximity to a bait site. However, this may not necessarily be true. The lure crop at Foam Lake is similarly located yet this field is the least beneficial of all lure crop areas in terms of yield obtained for costs required to produce and harvest the crop (Table 3). Some solutions to the problem there may lie in adjusting management techniques (Sect. 4.3.4) to reverse the negative benefit.

Waterhen

The Waterhen lure crop comprises 375 acres lying adjacent to Waterhen Marsh for a distance of 3.2 km. It is particularly attractive for all types of waterfowl and until recent years has been consistently well utilized. Management problems have possibly contributed to a recent decline in waterfowl use with the result that some acreage has been harvested annually since 1982. This field has the highest cost-benefit due to consistently high yields (36.8 bushels salvaged/harvested acre) and relatively low production costs ($31.10/seeded acre) (Table 3).

Much of the salvage production from this field appears to have taken place at expense to the efficiency of damage prevention the field is to provide and this problem must be rectified. Then, if some acreage still remains unutilized by waterfowl it is obviously beneficial to the program to retain that acreage for salvage grain production. Waterhen and Street Lak. are the only isolated lure crops (ie. without adjoining bait stations) with consistently unused acreage which have demonstrated a positive cost-benefit (Street Lake has been a break-even situation). This suggests both their own merit as well as the need to carefully evaluate existing acreage requirements in the other similar areas.

4.3.4 Managing Lure Crops to Achieve Positive Cost-Benefits From Currently Unused Acreage

Management of lure crop acreage should be carefully directed toward minimizing the acreage used and meeting the following objectives: 1) maximize the damage prevention capability of each field during the normal harvest period; 2) provide the most cost-efficient balance between production costs and yields produced; 3) ensure yields are sufficient to warrant harvesting operations on under-utilized acreage.

To minimize the acreage retained requires field evaluation of lure crop use by waterfowl. The present analyses indicates that acreage in excess of normal requirements for waterfowl is generally

not cost-beneficial to the program. The evaluation process should identify what acreage can be excluded, where on the field(s) these acres can be taken out of production, and recommend future management techniques for excluded acres. Importance should be given techniques which enhance waterfowl use of remaining acreage, such as seeding to perennial forage crops preferred by foraging geese and cranes, or in some way buffering the remaining lure crop from disturbance. Where no advantages can be had by such specialized management or where whole fields are to be excluded, the area should be referred to the Regional Biologist to determine ultimate use.

To maximize the damage prevention capability of each field during the normal harvest period requires sufficient seeded acreage for waterfowl needs during a normal season. This may vary by area, relative to the number of waterfowl-days during harvest period and the normal crop-yield capability of the land. Crops seeded and swathed early maximize their availability for waterfowl during the critical early harvest period.

To provide the most cost-efficient balance between production costs and yield produced the primary management technique is determining the most efficient rotation to supply the grain requirement. Fallow rotations reduce input costs of fertilizer and weed control, but reduce the seeded acreage available. Input costs are high for continuously seeding the same acreage, but this maximizes use of the available acreage. The variety of practicable crop rotations will vary by area but can be determined once the seeded acreage requirements for waterfowl are clearly known. Other management decisions such as selecting higher yielding crop varieties would also precede the actual seeding date.

Once the crop is seeded, options are limited for reducing input costs while retaining yield potential. The primary management decision then becomes whether to harvest under-utilized acreage. This should be based on ensuring that harvesting costs will be retrieved through the salvaged yield. To ensure this break-even benefit, costs of combining plus primary and secondary hauling must be $\leq$ commercial value. Using current values the required yield is calculated as follows:

Market Value = $2.48/bu.
Primary Hauling = $0.10/bu.
Secondary Hauling = $0.09/bu.
Combining = $15.00/acre

Then: $2.48 - $0.19 = $2.29

So: $$\frac{\$15.00}{\text{required yield}} \leq 2.29$$

And: Required Yield = 6.6 bushels salvaged/harvested acre

Considering wastage from combining and potential grade and yield losses due to weathering it is unlikely that any acreage with in-field yields less than 8 bushels per acre could be worth harvesting at current rates.

5. Summary

5.1 General Results

1. With harvesting considered as the only cost of grain salvaged, a saving of $99,865 ($0.43/bushel fed) is realized when compared to cost of purchase of that grain at market price.
2. Including costs of both producing and harvesting salvage grain result in a negative cost benefit of $43,809 ($0.19/bushel fed).
3. A positive cost-benefit results when production and harvesting costs per harvested acre ÷ yield (as bushels salvaged per acre) < mean market cost per bushel minus hauling costs per bushel salvaged.
4. Crop yield is the primary manageable determinant in the benefit analysis. Crop rotation and crop type are the most important management techniques available to affect input costs.
5. Mean break-even yields rise steadily with increased production costs, eg. production costs of $50 per acre require a yield of 33.1 bushels salvaged/acre to break even; costs of $60 per acre require 39.7 bushels; $70/acre requires 46.4 bushels.

6. Determine yield required to harvest as: Market Cost - Primary and Secondary Hauling Costs for Salvage $\leq$ Combining Rate Per Acre ÷ Yield Required.

7. Using current values crops yielding less than 8 bushels per acre before harvesting should not be harvested.

5.2 Results for Specific Areas

1. Diefenbaker Lake and Street Lake are primarily Grain Production Crops. Other crops where salvage has been obtained are primarily Damage Prevention Crops and include Condie, Nicolle Flats, Ponass Lake, Thunder Creek, Foam Lake and Waterhen. Salvage from Eyebrow Lake was excluded from the analysis.

2. Diefenbaker Lake had a negative cost-benefit of $32,635 based on production costs for all seeded acres and harvesting costs for harvested acres. This calculation method was appropriate since the lure crops are never well utilized by waterfowl.

3. Street Lake had a positive cost-benefit of $2,362 after including production and harvesting costs for all harvested acres. This calculation method was appropriate since the Street Lake lure crop is well utilized by waterfowl when the lake has water.

4. Ponass Lake and Waterhen had positive cost-benefits based on production and harvesting costs for all harvested acres.

5. Condie, Nicolle Flats, Foam Lake and Thunder Creek had negative cost-benefits based on production and harvesting costs for all harvested acres.

6. Recommendations

6.1 General Recommendations

1. Those lure crops where break-even yields are not realized and/or the acreage is consistently under-utilized should be reduced to an acreage sufficient to prevent waterfowl damage in a normal year.

2. The high break-even yield in 1985 (39.7 bu/acre) and the trend for annual increase means that purchase of lure crops in new areas should be carefully limited to the acreage required to feed waterfowl. Acreage should not be acquired solely for the purpose of providing grain to harvest for use at secondary locations.
3. To ensure a positive cost-benefit harvesting should not be authorized on lure crops yielding less than 8 bushels per acre.
4. Acreage to be excluded from lure crop production should first be managed to enhance waterfowl use of remaining acres. Where excess acreage is still available the land should be referred to the Regional Biologist to make final recommendations for its disposition.

6.2 Recommendations for Specific Areas

1. Most, or all lure crop acreage at Diefenbaker Lake should be released from the program. An immediate field evaluation is required to determine what, if any, acreage should be retained.
2. Waterfowl use of the Street Lake lure crop should be evaluated at a time when the Street Lake basin has water in the fall.
3. All existing acreage at Waterhen Lake should be retained. Routine management practices such as early seeding and swathing need to be re-established to improve waterfowl use. Under-utilized acreage should continue to be harvested for bait stations.
4. Current management techniques at Ponass Lake should be continued as all objectives there are being met.
5. New crop management techniques are required at Foam Lake. Continuous cropping should be discontinued in favour of a 2/3 - 1/3 fallow rotation.
6. Acreage reductions at Thunder Creek and Condie should be preceded by field evaluations to determine which acreage to exclude and how best to manage the remainder.

7. Acreage at Nicolle Flats was reduced by 160 acres in 1984. This area should be monitored to see if further reductions are required.

8. Six lure crop areas not included in the present analysis were Tobin Lake, Leaf Lake, Eyebrow, Rankin Marsh, North Battleford, and Wascana. Ongoing evaluations at Tobin and Leaf Lake should result in meeting objectives there. The small acreage at North Battleford is well utilized by waterfowl and there are no outstanding management problems. Management of the Wascana lure crop is not under authority of this program. Lure crops at Eyebrow and Rankin Marsh should be evaluated to determine whether existing acreage meets or exceeds requirements and to recommend possible options for managing farming operations.